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10/670,587	09/25/2003	Jinru Bian	010049US	7481

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Rodel Holdings, Inc.
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EXAMINER

WEBB, GREGORY E

ART UNIT	PAPER NUMBER
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1751

DATE MAILED: 09/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/670,587

Applicant(s)

BIAN, JINRU

Examiner

Gregory E. Webb

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 July 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) 9 and 10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 1.19(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 011205, 010804

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-6, and 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang (US6638143).

Concerning the polishing fluid, Wang teaches the following:

FIG. 3 demonstrates high CMP polishing rates and uniformity achieved employing with CMP compositions of the present invention compared to CMP

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slurries without ion exchange materials.(see col. 4, lines 55-60)

Concerning the polishing, Wang teaches the following:

Ion exchange materials are employed in CMP methodologies to polish or thin a semiconductor substrate or a layer thereon. Embodiments include a polishing pad having an ion exchange material thereon and polishing a semiconductor substrate or a layer thereon with the polishing pad or a CMP composition including an ion exchange material therein and polishing the substrate or a layer thereon with the CMP composition or both.(see abstract)

Concerning the tantalum substrate, Wang teaches the following:

Barrier film 70 having a thickness of about 200-500 .ANG. overlays dielectric layer 60. Typical barrier films include tantalum nitride, titanium nitride, titanium tungsten, tantalum, titanium, tantalum silicon nitride, tungsten nitride, 10 alloys of these materials, composites thereof, etc. A conductive layer 80 is then deposited over a top surface of the layer 70, within the via opening in layer 60. Conductive layer 80 can be a metal interconnect, a material such as tungsten, aluminum, and aluminum alloy, copper, gold, silver, refractory metals, conductive oxides, composites thereof, or the like.(see cols. 10-11)

Concerning the hydrazine, the imine and the specific hydrazine, Wang teaches the following:

Additional conventional components can be incorporated into the CMP composition of the present invention to achieve their known effect. For example, a film forming agent can be added and can be any compound or

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mixtures of compounds that are capable of facilitating the formation of a passivation layer of metal oxides and dissolution inhibiting layers on the surface of a metal layer. Useful film forming agents are cyclic compounds such as imidazole, benzotriazole, benzimidazole and benzothiazole and their derivatives with hydroxy, amino, imino, carboxy, mercapto, nitro and alkyl substituted groups, as well as urea, thiourea and others.(see col. 8, lines 47-58)

Concerning the abrasive particles, Wang teaches the following:

The CMP composition can also include an abrasive. The abrasive is typically a metal oxide abrasive. The metal oxide abrasive may be selected from the group including alumina, titania, zirconia, germania, silica, ceria and mixtures thereof In an embodiment of the present invention, the CMP composition includes from about 1.0 wt % to about 50 wt %, e.g. from about 2 wt % to about 20 wt % an abrasive.(see col. 8, lines 40-46)

Concerning the oxidizing agent, Wang teaches the following:

Oxidizers useful in the present invention comprise peroxy compounds, e.g. compounds which may disassociate through hydroxy radicals. Such peroxy compounds include hydrogen peroxide and its adducts such as urea hydrogen peroxide and percarbonates, organic peroxides such as benzoyl peroxide, peracetic acid, and di-t-butyl peroxide, monopersulfates, dipersulfates, sodium percarbonate and sodium peroxide. The oxidizing agent can also be an inorganic or a compound containing an element in its highest oxidation state. Examples of inorganics and compounds containing an element in its

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highest oxidation state include but are not limited to periodic acid, periodate salts, perbromic acid, perbromate salts, perchloric acid, perchloric salts, perboric acid, nitrate salts (such as cerium nitrate, iron nitrate, ammonium nitrate), perborate salts and permanganates. Other oxidizing agents include bromates, chlorates, chromates, iodates, iodic acid, and cerium (IV) compounds such as ammonium cerium nitrate.(see col. 8, lines 15-32)

Concerning the complexing agent, Wang teaches the following:

Although employment of an ion exchange material in the present CMP composition minimizes or even eliminates the need for additional complexing agents, it may be beneficial to add complexing agents for certain applications. In this regard, a wide range of conventional organic acids, salts of organic acids, and mixtures thereof are useful in the CMP composition of the present invention to enhance the selectivity to oxide polishing rate, such as monofunctional acids, di-functional acids, hydroxyl/carboxylate acids, chelating, non-chelating acids, and their salts. The organic acid can be selected from the group of acetic acid, adipic acid, butyric acid, capric acid, caproic acid, caprylic acid, citric acid, glutaric acid, glycolic acid, formic acid, fumaric acid, lactic acid, lauric acid, malic acid, maleic acid, malonic acid, myristic acid, oxalic acid, palmitic acid, phthalic acid, propionic acid, pyruvic acid, stearic acid, succinic acid, tartaric acid, valeric acid and derivatives, including salts thereof(see cols. 8-9)

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Concerning the corrosion inhibitor, Wang teaches the following:

Stabilizers can be added to CMP composition of this invention including phosphoric acids and salts thereof. The addition of one or more phosphoric acids to the CMP composition of this invention may also inhibit metallic corrosion.(see col. 9, lines 40-45).

Claims 1-6, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee (US6436834).

Concerning the tantalum substrate, the imine, hydrazine and the specific hydrazine, Lee teaches the following:

Chemical-mechanical abrasive slurries respectively containing semicarbazide hydrochloride, aminoguanidine carbonate, and guanidine carbonate, and having a pH value ranging from 3.8 to 4.6 were prepared. The resultant slurries were used to polish copper, tantalum nitride, and TEOS films under the following conditions:(see example 4)

Concerning the claimed imine, Lee teaches the following:

8. A composition according to claim 1 wherein said abrasion accelerator is selected from the group consisting of methyl glycinate, glycinamide, aminoguanidine, semicarbazide, guanidine, urea, formamidine, acetamidine, formamide, acetamide, formyl hydrazine, acethydrazide, ethyl glycinate, methyl carbazate, ethyl carbazate, methyl carbamate, ethyl carbamate, an acid-addition salt thereof and mixtures thereof.(see claim 8)

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Concerning the abrasive particles, Lee teaches the following:

The abrasive used in the abrasive composition of the invention can be any commercially available abrasive, such as SiO_2 , Al_2O_3 , ZrO_2 , CeO_2 , SiC , Fe_2O_3 , TiO_2 , Si_3N_4 , or a mixture thereof. These abrasives normally have the advantages of high purity, high surface area, and narrow particle size distribution, and are thus suitable for use in abrasive compositions as abrasive particles.(see cols. 4-5)

Concerning the oxidizing agent, Lee teaches the use of hydrogen peroxide which are considered conventional (see col. 5, lines 50-61)

Concerning the complexing agent, Lee teaches the following:

11. The composition according to claim 10, wherein said acidic component is selected from the group consisting of nitric acid, hydrogen chloride, carbonic acid, sulfuric acid, sulfurous acid, phosphoric acid, phosphorous acid, chloric acid, bromic acid, iodic acid, perchloric acid, perbromic acid, periodic acid, formic acid, acetic acid, propionic acid, butyric acid, valeric acid, hexanoic acid, malonic acid, succinic acid, glutanic acid, dipic acid, glycolic acid, lactic acid, citric acid, malic acid, tartaric acid, oxalic acid, glycine, creatine, dimethylglycine, alanine, and a mixture thereof.(see claim 11)

Claims 1-6, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Avanzino (US6350687).

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Concerning the polishing fluid and the abrasive particles, Avanzino teaches the following:

Adverting to FIG. 2, the portions of the Cu or Cu alloy layer 13 extending beyond opening 11 are removed, as by CMP stopping substantially on the underlying TaN barrier layer 20. CMP can be performed with a slurry, typically an aqueous suspension comprising an abrasive, such as alumina, an organic dispersant and an oxidizing agent. Buffing, employing pure water, can then be conducted on a buff pad to remove remaining slurry, particularly particulate materials. CMP is then performed employing a more aggressive slurry to remove the underlying TaN barrier layer followed by water buffing on a buff pad to remove residual slurry particulates.

Subsequent to such CMP procedures, a further cleaning step can be conducted to remove contaminants such as abrasives, electrolytes and copper compounds from the surfaces of the wafer, e.g., double sided brush scrubbing.(see col. 6, lines 33-48)

Concerning the polishing and the oxidizing agent, Avanzino teaches the following:

removing any portion of the Cu or Cu alloy layer and barrier layer beyond the opening by chemical mechanical polishing, leaving an exposed surface not substantially oxidized.(see claim 7)

Concerning the tantalum substrate, Avanzino teaches the following:

One approach to forming Cu plugs and wiring comprises the use of damascene structures employing CMP, as in Teong, U.S. Pat. No. 5,693,563. However, due to Cu diffusion through dielectric interlayer materials, such as

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silicon dioxide, Cu interconnect structures must be encapsulated by a diffusion barrier layer. Typical diffusion barrier metals include tantalum (Ta), tantalum nitride (TaN), titanium nitride (TiN), titanium-tungsten (TiW), tungsten (W), tungsten nitride (WN), Ti-TiN, titanium silicon nitride (TiSiN), tungsten silicon nitride (WSiN), tantalum silicon nitride (TaSiN) and silicon nitride (silicon nitride) for encapsulating Cu. The use of such barrier materials to encapsulate Cu is not limited to the interface between Cu and the dielectric interlayer, but includes interfaces with other metals as well.(see col. 3, lines 9-40)

Concerning the claimed imine, hydrazine, specific hydrazine and the corrosion inhibitor, Avanzino teaches the following:

5. The method according to claim 1, wherein the copper corrosion-inhibiting chemical is selected from the group consisting of azoles, benzotriazole, 1,2,4-triazole, 8-hydroxyquinoline (an imine), 2-mercaptobenzimidazole, imidazole (preferred hydrazine), and alkanethiols.(see claim 5).

Claims 1-6, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Fang (US6805812).

Concerning the polishing fluid, Fang teaches the following:

Inventive CMP System 1E also exhibited an increased removal rate when compared to the control CMP Systems 1A-1C. CMP System 1E, prepared using an additive of nitrilotris (methylene) triphonic acid, exhibited a removal

rate that was nearly 20% better than that of control CMP System 1A, over 50% better than that of control CMP System 1C, and nearly 100% better than control CMP System 1B. In addition, the use of inventive CMP System 1E resulted in a surface roughness very similar to that associated with control CMP Systems 1A-1C.(see col. 8, lines 1-10)

Concerning the polishing, Fang teaches the following:

In a typical chemical-mechanical polishing (CMP) system, a silicon wafer, semiconductor, or other such substrate to be polished is placed in direct contact with a rotating polishing pad. During the polishing process, the polishing pad is rotated while a downward force is maintained against the back of the substrate to cause the front of the substrate to contact the polishing pad. An abrasive and chemically reactive solution, referred to as a chemical-mechanical polishing composition or slurry, is applied to the polishing pad during the polishing (also referred to as planarization) of the substrate. The polishing composition often is comprised of an abrasive, an oxidizing agent, a liquid carrier, and other useful additives. The polishing composition assists the polishing process by both mechanically abrading and chemically reacting with the surface of the substrate. The polishing process is facilitated by the rotational movement of the polishing pad relative to the substrate while the polishing composition is provided to the substrate/polishing pad interface.(see col. 1, lines 14-34)

Concerning the tantalum substrate, Fang teaches the following:

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The CMP system further comprises a per-type oxidizer. An oxidizing agent is particularly useful when polishing metals and metal-based components such as substrates containing titanium, titanium nitride, tantalum, tantalum nitride, copper, tungsten, aluminum, and mixtures, combinations, and alloys thereof (e.g., aluminum/copper alloys).(see col. 3, lines 50-55)

Concerning the claimed imine, Fang teaches the following:

Thus, it is apparent that the existence of the additives 1,2,4-triazole (CMP Systems 2B) and piperazine (CMP Systems 2C) result in a much improved removal rate. This example demonstrates that the inventive CMP method involving these additives significantly improves metal substrate polishing.(see col. 9, lines 48-54)

Concerning the hydrazine, specific hydrazine and the corrosion inhibitor, Fang teaches the following:

The CMP system further can include a film-forming agent. The film-forming agent can be any compound or mixture of compounds that facilitates the formation of a passivation layer of metal oxide and/or dissolution-inhibiting layer on the surface of a metal to minimize the chemical removal of the metal from the substrate. Suitable film forming agents comprise at least one organic heterocycle ring formed from 5 to 6 atoms, wherein at least one of such atoms is a nitrogen atom. Particularly useful film forming agents are nitrogen- or sulfur-containing cyclic compounds such as benzotriazole, triazole, benzimidazole, imidazole,

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benzothiazole and derivatives thereof with hydroxy, amino, imino, carboxy, mercapto, nitro, and alkyl substituted groups, as well as urea and thiourea. A preferred film-forming agent is benzotriazole.(see col. 4, lines 32-46)

Concerning the abrasive particles, Fang teaches the following:

The abrasive can be any suitable abrasive. For example, the abrasive particles can be natural or synthetic and can include diamond (e.g., polycrystalline diamond), garnet, glass, carborundum, and metal oxide (e.g., silica, fused alumina, ceramic alumina, chromia, and iron oxide) particles. The abrasive particles can be coated particle abrasives. The abrasive desirably is a metal oxide abrasive and more preferably is selected from the group consisting of alumina, silica, titania, ceria, zirconia, germania, magnesia, co-formed products thereof, and combinations thereof. Most preferably, the abrasive is silica. The metal oxide abrasive generally will comprise fumed, precipitated, and/or condensation-polymerized metal oxide particles.(see col. 3, lines 1-9)

Concerning the oxidizing agent, Fang teaches the following:

Any suitable amount of the oxidizer can be present in the polishing composition. Typically, about 0.01 wt. % or more (e.g., about 0.1 wt. % or more) oxidizer will be present in the polishing composition. More typically, about 0.2 wt. % or more (e.g., about 0.5 wt. % or more) oxidizer will be present in the polishing composition. The amount of oxidizer in the polishing composition typically will not exceed about 10

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wt. %, and more typically will not exceed about 5 wt. % (e.g., will not exceed about 2 wt. %).(see col. 4, lines 15-23)

Concerning the complexing agent, Fang teaches the following:

The first, second, and third CMP systems (control) contained 1 wt. % glycine, 1 wt. % nitrilotriacetic acid, and 1 wt. % 2-aminoethyl dihydrogen phosphate, respectively, as the additive (CMP Systems 1A, 1B, and 1C, respectively). The fourth and fifth CMP systems (inventive) contained 1 wt. % N-(phosphonomethyl) iminodiacetic acid and 1 wt. % of nitrilotris (methylene) triphonic acid, respectively, as the additive (CMP Systems 1D and 1E, respectively).(see example 1)

Claims 1- 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Rothgery et al (US 4,479,917).

Concerning the specific imine and the hydrazine, Rothgery teaches the following:

Guanidine hydrochloride (57 g, 1.67 mole) was placed in 500 ml of ethanol and 64% hydrazine solution (157 g, 3.14 mole) was added and the mixture refluxed 4 hours. On cooling the product formed. It was filtered, washed and dried giving 71.5 g of crude TAGC. Recrystallization from water left 61.8 g of product.(see example 6)

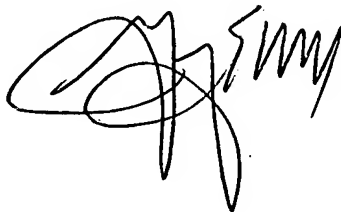
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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory E. Webb whose telephone number is 571-272-1325. The examiner can normally be reached on 9:00-17:30 (m-f).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'G. Webb', with a large, stylized initial 'G' and a series of loops and strokes extending to the right.

Gregory E. Webb
Primary Examiner
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gew